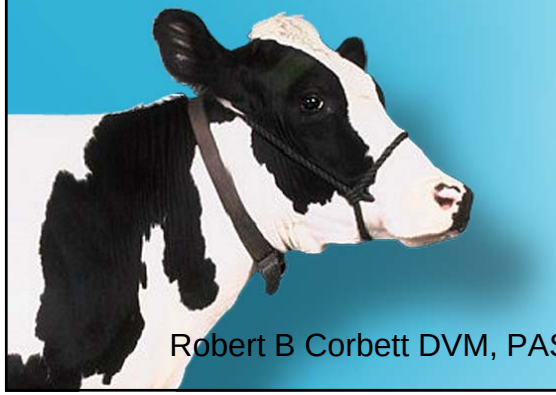
Accelerated Growth:
How We Can Influence Her Development



Robert B Corbett DVM, PAS, Dipl ACAN

Introduction

- Traditional method of raising heifers is to determine a specific age at which heifers are assumed to be the appropriate size for weaning and breeding, depending on the nutrition and management of that particular dairy.
- Heifer programs are considered to be a major cost with no return until calving
- Rations formulated for least cost per day instead of cost per pound of gain

Introduction

- Heifers have tremendous ability to utilize protein for increased growth rates
- Nutrition and management needs to be changed to allow the heifer to grow according to its own genetic potential
- Puberty depends on size, not age
- Heifers should be bred according to size and not a specific age.

Condition at Birth

- Heifer should be born with adequate body condition
- Thin heifers are born weak with little body reserves (brown fat and muscle tissue)
- Common when dry cows are on pasture without supplementation
- Heifer devotes a major part of early nutrition to building fat and protein reserves that should already be there
- Slows early growth rates

Protein

- Antibodies and many cell signaling factors are proteins
- Proteins are source of glucose for the fetus and for mammary gland post calving
- Limited protein reserves available in the cow, app. 25-35 kg
- Under feeding MP in close-ups causes negative protein balance prior to calving

Uterine Uptake in Relation to Maternal Supply of Organic Nutrients in Late-Pregnant Cows

		Uterine Uptake	
Nutrient	Maternal Supply, g/d	g/d	% Maternal Supply
Glucose	1,476	666	46
Amino Acids	998	718	72
Acetate	2,196	270	12

Fetal Development

- During late pregnancy fetal metabolic rate is twice that of dam
- Glucose and lactate account for 50 to 60% of metabolic fuel
- Placental transport of fatty acids is limited
- Fetal uptake of acetate accounts for 10 to 15% of metabolic fuel
- Amino acids account for remaining 30 to 40% of energy

Thin Newborn Calves

Thin Newborn Calves

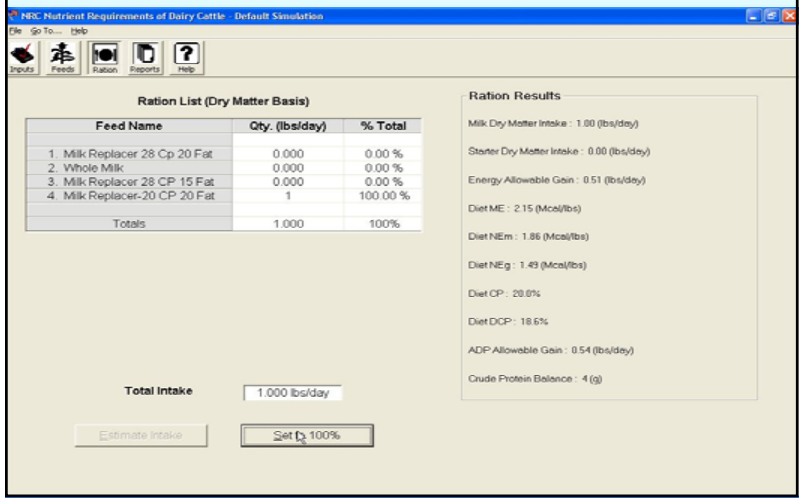
Colostrum Management

- Inadequate amounts of colostrum result in increased susceptibility to disease.
- Research indicates calves not receiving adequate colostrum grow at 2/3 the rate of other calves.
- Need one gallon (4 liters) immediately after birth, followed by 2 qts (2 liters) within 6-8 hours.
- Should be from mother and not pooled.
- Freezing destroys White Blood Cells
- Cleanliness affects absorption
- Epigenetic programming for future milk production, reproductive efficiency, and efficiency of gain.

Traditional Milk Replacers
Whole Milk vs. Milk Replacer

- Whole Milk
  - 12.7% solids
  - 27% protein
  - 30% fat
  - 0.285 lbs protein/gal
  - 0.317 lbs fat/gal
  - 50% more protein
  - 67% more fat
- Milk Replacer 20:20
  - 11.4% solids (1 lb per gallon of water)
  - Water = 8.32 lbs/gal
  - Milk Replacer is 95% dry matter
  - 20% protein
  - 20% fat
  - 0.190 lbs protein/gal
  - 0.190 lbs fat/gal

NRC 20:20 MR 1lb/Gal 2qts BID 68ºF



20:20 MR 1lb/Gal 2qts BID 68ºF
120 grams/liter 2 L BID 20°C

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)
Temperature : 68.0 deg. F

Diet ME : 2.15 (Mcal/lbs)
Diet NEm : 1.86 (Mcal/lbs)
Diet NEg : 1.49 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : 0.51 (lbs/day) ADP Allowable Gain : 0.54 (lbs/day)

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.00 (lbs/day)
Total Starter Dry Matter Intake : 0.00 (lbs/day)

20:20 MR 1lb/Gal 2qts BID 32º F
120 grams/liter 2 L BID 0° C

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)
Temperature : 32.0 deg. F

Diet ME : 2.15 (Mcal/lbs)
Diet NEm : 1.86 (Mcal/lbs)
Diet NEg : 1.49 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : Weight Loss ADP Allowable Gain : Weight Loss

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.00 (lbs/day)
Total Starter Dry Matter Intake : 0.00 (lbs/day)

Whole Milk 2qts BID 68º F
Leche Entera 2 L BID 20° C

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)
Temperature : 68.0 deg. F

Diet ME : 2.44 (Mcal/lbs)
Diet NEm : 2.10 (Mcal/lbs)
Diet NEg : 1.68 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : 0.72 (lbs/day) ADP Allowable Gain : 0.76 (lbs/day)

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.00 (lbs/day)
Total Starter Dry Matter Intake : 0.00 (lbs/day)

Whole Milk 2qts BID 32º F
Leche Entera 2 L BID 0° C

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)
Temperature : 32.0 deg. F

Diet ME : 2.44 (Mcal/lbs)
Diet NEm : 2.10 (Mcal/lbs)
Diet NEg : 1.68 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : Weight Loss ADP Allowable Gain : Weight Loss

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.00 (lbs/day)
Total Starter Dry Matter Intake : 0.00 (lbs/day)

28:20 MR 2.63 lbs in 7qts per day 180 grams/liter 7 L cada dia

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)	Diet ME : 2.21 (Mcal/lbs)
Temperature : 32.0 deg. F	Diet NEm : 1.91 (Mcal/lbs)
	Diet NEg : 1.53 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : 2.32 (lbs/day) ADP Allowable Gain : 2.64 (lbs/day)

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 2.63 (lbs/day)
Total Starter Dry Matter Intake : 0.00 (lbs/day)

What is Biologically Normal?

- If left on its mother a 100 lb calf will:
  - Nurse 6 to 10 times per day
  - Consume between 16 and 24% of its body wt per day as milk (20% average)
  - Consume 1.9 to 2.8 gallons of milk per day
  - Consume 2 to 3 lbs of dry milk solids per day
  - Consume 2 to 3 times more milk solids per day than calves on 1 lb of 20:20 milk replacer
  - Consume 0.54-0.86 lbs protein vs. 0.19 lbs

Milk Replacer Feeding Program

- 20% Protein and 20% Fat is the most common product used
- Impossible to meet nutritional requirements of milk-fed calves with this product at suggested feeding rate (12% solids & 10% of body weight per day total volume)
- If only product available, must increase the amount of dry matter fed per day by increasing solids content, volume fed, and feeding frequency.

Milk Replacer Feeding Program

Advantages

- Lower bacteria counts than unpasteurized non-saleable milk
- Johne's control programs
- More consistent if proper mixing procedures are followed
- Can mix correct volume as needed per day

Milk Replacer Feeding Program

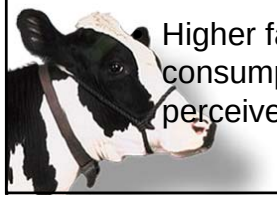
- Approximately 15 % of body weight during the first week of life (3 quarts twice per day for the average Holstein calf)
- Increase to approximately 20% of body weight at 8 days of age (4 quarts twice per day)
- Increase solids content to at least 15% starting at first feeding
- Maintain at this level until ready to be weaned

Milk Replacer Weaning Program

- Do not force calves to increase starter intake by decreasing milk intake
- Maintain same amount of milk until sufficient calf starter is consumed to wean the calf
- Common to see respiratory disease outbreaks following reductions in amount of milk being fed
- Rumen must be developed sufficiently to digest dry starter feed efficiently

Whole Milk Feeding Program

- Hopefully the milk has been pasteurized
- Same volumes as with milk replacer (3 quarts 2X per day for first week followed by 4 quarts 2X per day on day 8 until weaning)
- Can increase solids content by adding milk replacer powder to whole milk. Monitor solids content.
- Higher fat content may delay starter consumption and weaning (should not be perceived as a problem)



Whole Milk Feeding Program

- More economical to feed non-salable milk
- More difficult to maintain consistency when volume of hospital milk changes daily
- Pasteurization is important
- Must have a capable person in charge of mixing the milk with milk replacer, and operating and maintaining the pasteurizer
- Make sure that milk is heated up to 105° F just prior to feeding.

Environmental Temperature and Nutritional Requirements

- Thermoneutral range is 50° to 68° F
- High temp & humidity: ↑ energy demands and ↓ appetite
- Low temps: ↑ energy demands and ↓ ability to digest dry matter
- Must increase solids content, volume fed, or number of times fed
- However, if maximizing nutrient intake, program does not have to be changed

Cold Temperatures Management Procedures

- Increase solids content to 15-18%
- Feed 3 times per day
- Warm milk or replacer to 105° F (40°C)
- Free choice water at all times
- Calves at 39° F (4°C) had 32% increase in energy requirement over calves at 50° F (10°C)
- At 0° F energy requirement more than doubles
- Inadequate energy results in protein depletion

Increasing Nutrient Intake

- Anything that can be done to increase the amount of protein and energy consumed by the milk-fed calf will result in an increase in growth rate, and a significant improvement in the health and productivity of that calf.

Weaning

- Depends on milk feeding program and on quality of calf starter.
- Calves should not be forced to be weaned by purposely reducing milk
- Protein and fat in milk are much more digestible than that in calf starter
- If not consuming enough starter prior to weaning, calves will suffer a loss of body condition following weaning

Weaning

- Based on dry matter intake, <u>not age</u>
- Should be eating 2 lbs of calf starter per day for 3 consecutive days, if a high quality starter is being fed (23-25% protein)
- Typical starters are 18% protein, should be eating 4 lbs of starter prior to weaning
- High levels of starter intake early on is **<u>not</u>** a good sign. Sign of malnutrition.
- Post-weaning is most common time to see respiratory disease

8 Weeks Old: Milk and Grain (Penn State University)

8 Weeks Old: Milk, Grain and Hay (Penn State University)

Affects of Plane of Nutrition on

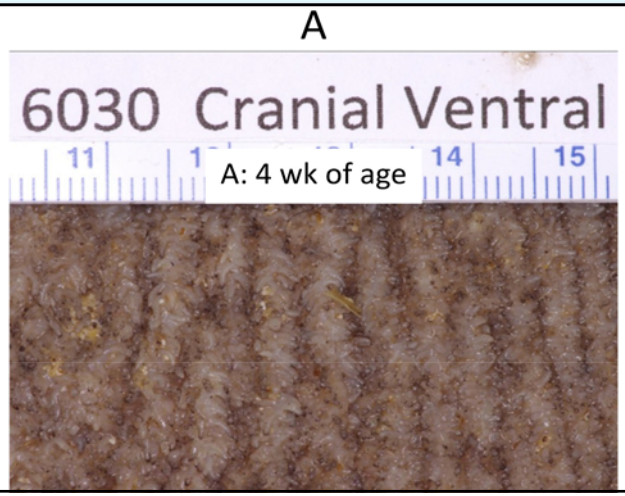
Rumen Pics
Courtesy of Dr. Jill Davidson
Purina Animal Nutrition

A = Full Potential (2.5# DM from CMR)

B = 1.5# DM from CMR

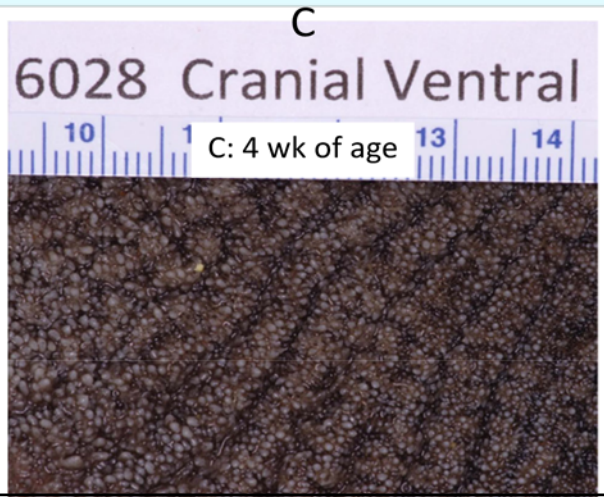
C = 1# DM from CMR

2.5 Pounds DM from Milk Replacer



1.5 Pounds DM from Milk Replacer

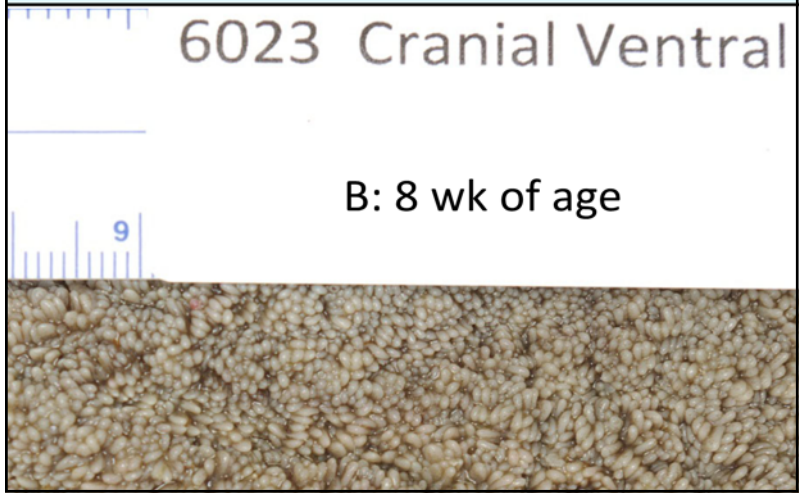
1 Pound DM from Milk Replacer



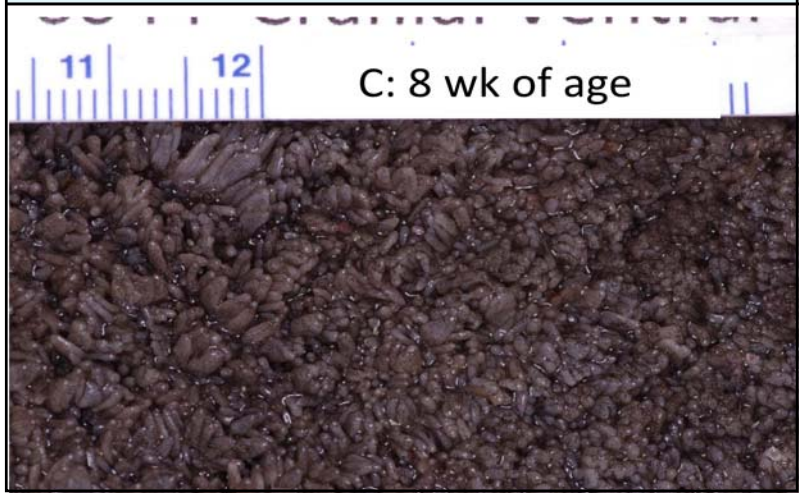
Comparison of 3 Feeding Rates

2.5 Pounds DM from Milk Replacer

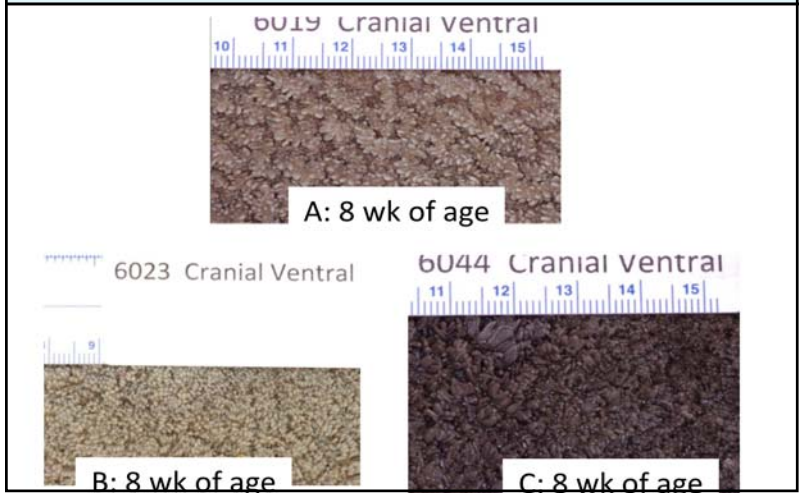
1.5 Pounds DM from Milk Replacer



1 Pound DM from Milk Replacer



Comparison of 3 Feeding Rates



What is Biologically Normal?

- Nurses 6 to 10 times per day
- Consumes between 16 and 24% body wt
- 100 lb calf consumes 16-24 lbs milk/day (1.9 to 2.8 gallons)
- 2 to 3 lbs of dry milk solids per day
- Allows 2 to 3 lbs of gain per day
- Milk replacer at 1 lb/day = 1/3 to ½ as much

Accelerated Growth Formulas

- 26 to 30% protein
- 15 to 20% fat
- Whole milk = 27% protein and 30% fat
- Protein is similar but lower in fat
- Promotes lean tissue gain
- Increases efficiency of gain
- Fat is a satiety agent

University of Illinois Study

- Fed 3 groups of calves, 26% protein-18% fat, at 10%, 14% and 18% of body weight
- 10% body weight gained 0.79 lbs/day
- 14% body weight gained 1.55 lbs/day
- 18% body weight gained 2.25 lbs/day
- Highest growth rate had highest lean tissue to fat tissue ratio

Accelerated Growth Formulas

- Stools will be softer than normal
- Larger volume of stool
- Less calf starter consumed initially:
  - Also contributes to softer stools
  - Calf starter offered at 3 days free choice
  - Cleaned out on daily basis
  - Increase amount fed as consumption increases

Weaning

- Avg age at weaning is about 8-10 weeks
- When consuming 2 lbs/day for 3 days, wean, if using a high protein calf starter
- If weaned based on intake, calves will be much more consistent in size when moved to 1st group pen
- Calf must have access to free choice water from day 2 on
- If caretaker not willing to provide water free choice, do not start on accelerated program

Advantages

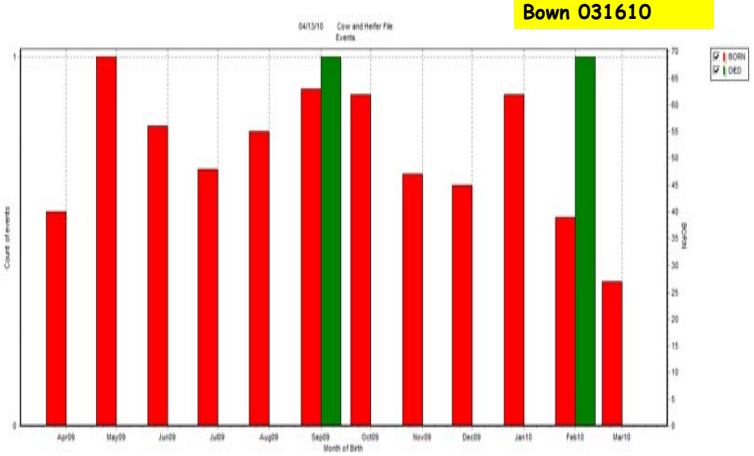
- Increased growth rate from birth until weaning
- Increased lean tissue to fat tissue ratio
- Increased efficiency of gain
- Increased parenchymal tissue in udder (more mammary tissue for potential future milk production)
- Improved immune response (decreased sickness and death) death loss <1%

Advantages (cont)

- Decreased labor and medicine costs (medicine costs decreased by 80%)
- Decreased age at first calving
- Program does not have to be altered depending on environmental conditions
- Increased 1st lactation milk production (approximately 1,700 lbs)

What has been the count of births and animals exiting before 6 weeks old, by month of birth?

Bown 031610



Long Term Effects of Morbidity

- Calves that experience a significant disease insult will never catch up to herdmates
- No such thing as compensatory growth
- Calves that experience a disease insult will never be able to reach the same potential milk production as an adult, even though fully recovered
- Cornell study: calves treated with antibiotics gave 493 kg less milk during 1st lactation than untreated calves

Disease Incidence and Nutrition

- When troubleshooting disease outbreaks, evaluate nutritional management
- Disease incidence often correlates to changes or deficiencies in the nutrition program
- Can significantly reduce disease incidence, morbidity and mortality by improving the nutritional management

Vaccine Efficacy and Nutrition

- Vaccine failure is almost always related to the ability of the animal to respond to the vaccine, not the vaccine efficacy
- Excellent nutrition is necessary to maximize immune response to vaccine
- Design vaccination program around periods of low stress, and ability of immune system to respond to antigen
- There is no such thing as the “perfect” vaccination program

Nutrition and Disease Resistance

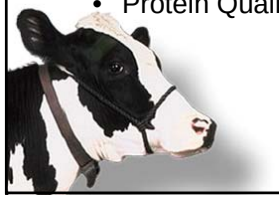
- Management and hygiene is extremely important
- Effects of nutrition on immune competency is often ignored
- Minimize environmental and social stress
- Calves have an amazing ability to fight disease if immune system has proper fuel
- Death loss of <1% is obtainable with proper management and nutrition

Starting New Feeding Programs

- Must make adjustments in solids content gradually
- Calves will usually not eat a new starter formulation for several days
- Expect to see larger volumes of stool with slight change in consistency
- Caretakers must be educated that this is normal

Calf Starter

- Texture
- Flavor
- Consistency
- Moisture
- Protein Content
- Protein Quality

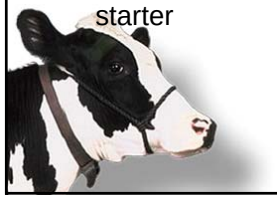


Calf Starter Feeding

- Start within 3 days of birth
- Fresh every day
- Start with small amount
- Gradually increase
- Free access to water
- Wean according to intake

Weaning

- 2 lbs/day (1 kg) for 3 days (25% protein)
- 4 lbs/day (18% protein)
- Best to wean gradually
- Don't cut one feeding
- Leave calf in hutch until eating 6-8 lbs (3 kg) starter



Higher Protein Calf Starters

- 22 to 26% protein
- Must maintain similar protein level
- Feed calf starter without hay for minimum of 2 weeks after weaning
- Monitor calf starter intake; should increase to 6-8 lbs per day within 1 week

Starter to Grower

- 6-8 lbs starter for 7 days
- Move to small group pens
- Leave on starter for 3-4 days
- Start on grower ration with 20% high quality hay

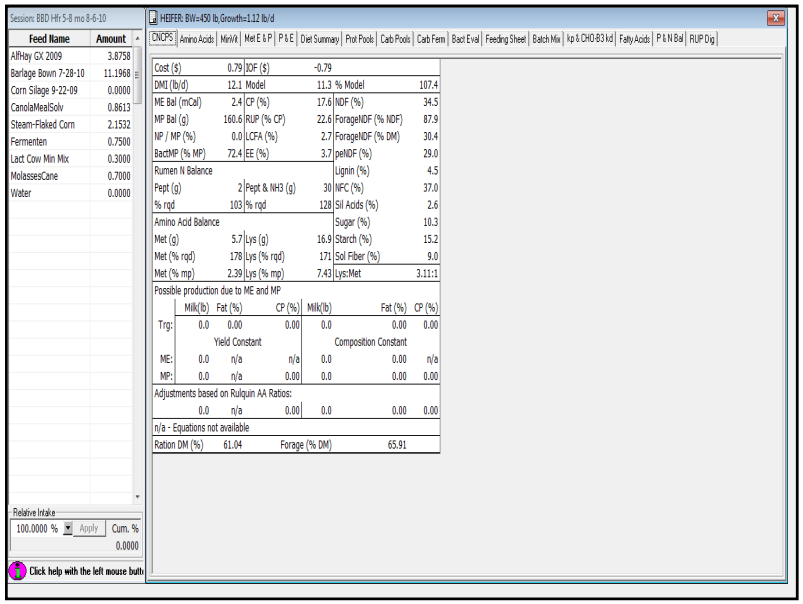
Uniformity in Size is Important in Maintaining Maximal Growth

- Weaning by dry matter intake helps ensure a more uniform size when moved to first group pens
- Calves that are smaller in size will never be able to reach their potential growth rate
- Small calves should be held back and placed with a group that is closer to its size

Low Protein Diets

- Most common problem interfering with growth rates and disease incidence
- Heifers are smaller, poor body condition, and “paunchy” with distended abdomens full of poor quality forages
- Heads often appear larger than expected


Underconditioned, Distended Abdomen


Session: BBD Hfr 5-8 mo 8-6-10
Feed Name
Amount
AlfHay GX 2009
3.8758
Barlage Bown 7-28-10
11.1968
Corn Silage 9-22-09
0.0000
CanolaMealSolv
0.8613
Steam-Flaked Corn
2.1532
Fermenten
0.7500
Lact Cow Min Mix
0.3000
MolassesCane
0.7000
Water
0.0000
Relative Intake
100.0000 %
Apply
Cum. %
0.0000
Click help with the left mouse butt
HEIFER: BW=450 lb, Growth=1.12 lb/d
CNCPS
Amino Acids
MinVit
Met E & P
P & E
Diet Summary
Prot Pools
Carb Pools
Carb Ferm
Bact Eval
Feeding Sheet
Batch Mix
kp & CHO-B3 kd
Fatty Acids
P & N Bal
RUP Dig
Cost ($)
0.79
IOF ($)
-0.79
DMI (lb/d)
12.1
Model
11.3
% Model
107.4
ME Bal (mCal)
2.4
CP (%)
17.6
NDF (%)
34.5
MP Bal (g)
160.6
RUP (% CP)
22.6
ForageNDF (% NDF)
87.9
NP / MP (%)
0.0
LCFA (%)
2.7
ForageNDF (% DM)
30.4
BactMP (% MP)
72.4
EE (%)
3.7
peNDF (%)
29.0
Rumen N Balance
Lignin (%)
4.5
Pept (g)
2
Pept & NH3 (g)
30
NFC (%)
37.0
% rqd
103
% rqd
128
SI Acids (%)
2.6
Amino Acid Balance
Sugar (%)
10.3
Met (g)
5.7
Lys (g)
16.9
Starch (%)
15.2
Met (% rqd)
178
Lys (% rqd)
171
Sol Fiber (%)
9.0
Met (% mp)
2.39
Lys (% mp)
7.43
Lys:Met
3.11:1
Possible production due to ME and MP
Milk(lb)
Fat (%)
CP (%)
Milk(lb)
Fat (%)
CP (%)
Trg:
0.0
0.00
0.00
0.0
0.00
0.00
Yield Constant
Composition Constant
ME:
0.0
n/a
n/a
0.0
0.00
n/a
MP:
0.0
n/a
0.00
0.0
0.00
0.00
Adjustments based on Rulquin AA Ratios:
0.0
n/a
0.00
0.0
0.00
0.00
n/a - Equations not available
Ration DM (%)
61.04
Forage (% DM)
65.91

Protein to Energy Ratio
5-8 Month Old Heifers

Total	13.10	10.71	2.40	564	392	172		
Maint	13.10	7.78	5.32	564	237	328		
Preg	5.32	0.00	5.32	328	0	328		
Lact	5.32	0.00	5.32	328	0	328		
Growth	5.32	2.93	2.40	328	155	172		
Reserves	2.40	0.00	2.40	172	0	172		
DMI Predicted		11.3	lb/d	Pept & NH3 Bal		26	g/d	124 %
DMI Actual		12.1	lb/d	Pept Bal		2	g/d	103 %
Predicted Ruminal pH		6.46		Urea Cost		0.270	mCal/d	
Target Growth		1.12	lb/d					
Input Growth		1.12	lb/d					
ME Allowed Growth		1.93	lb/d					
MP Allowed Growth		2.41	lb/d					
AA Allowed Growth (Histidine)		3.03	lb/d					
Concentus Weight		0.00	lb					

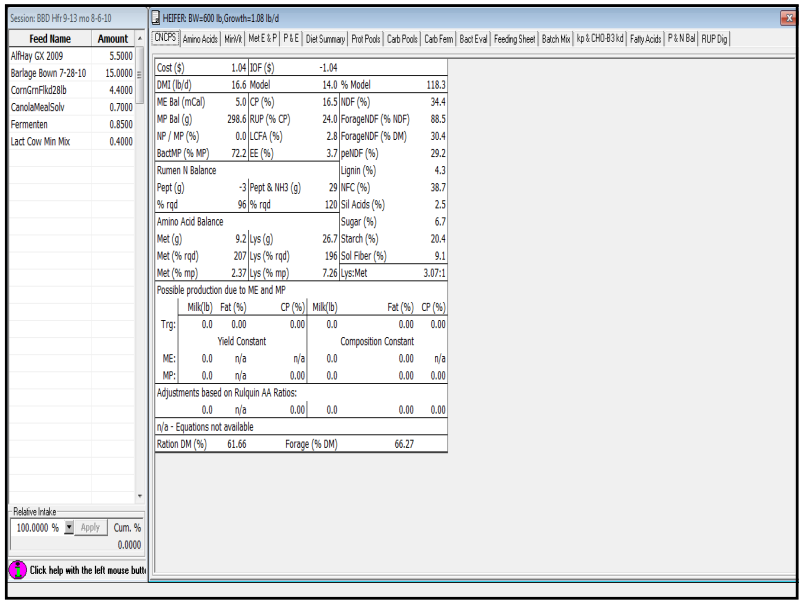
5 Month Old Heifer

Grouping of Heifers

- Smaller dairies: grouping is extremely difficult
- Wide range of age makes ration formulation difficult
- Must fulfill the requirements of the youngest animal to get maximum growth rate
- Monitor older animals in group to make sure they do not become over-conditioned

Heifer Rations

- Number of rations depends on group sizes & no. of heifers
- Analyze push-out
- May want to utilize lactating ration and push-out for heifers



Protein to Energy Ration
9-13 Month Old Heifers

Total	17.24	13.45	3.78	725	470	254			
Maint	17.24	9.86	7.38	725	320	405			
Preg	7.38	0.00	7.38	405	0	405			
Lact	7.38	0.00	7.38	405	0	405			
Growth	7.38	3.59	3.78	405	151	254			
Reserves	3.78	0.00	3.78	254	0	254			
DMI Predicted		13.9	lb/d	Pept & NH3 Bal		34	g/d	125	%
DMI Actual		16.4	lb/d	Pept Bal		1	g/d	101	%
Predicted Ruminal pH		6.46		Urea Cost		0.375	mCal/d		
Target Growth		1.08	lb/d						
Input Growth		1.08	lb/d						
ME Allowed Growth		2.07	lb/d						
MP Allowed Growth		2.98	lb/d						
AA Allowed Growth (Histidine)		3.63	lb/d						
Concentrate Weight		0.00	lb						

Breeding Criteria

- Breeding initiated when wither height is 51 inches (130 cm). Common range is 48-52.
- Approximately 28% reach breeding height by 10 months, 60% by 11 months, and the rest by 12 months.
- Delayed breeders should be culled.
- Evaluate heifers at 400 lbs for possible culls.

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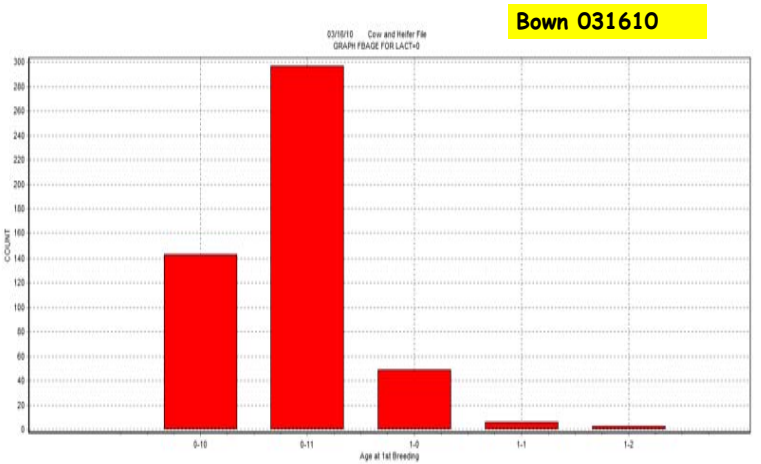
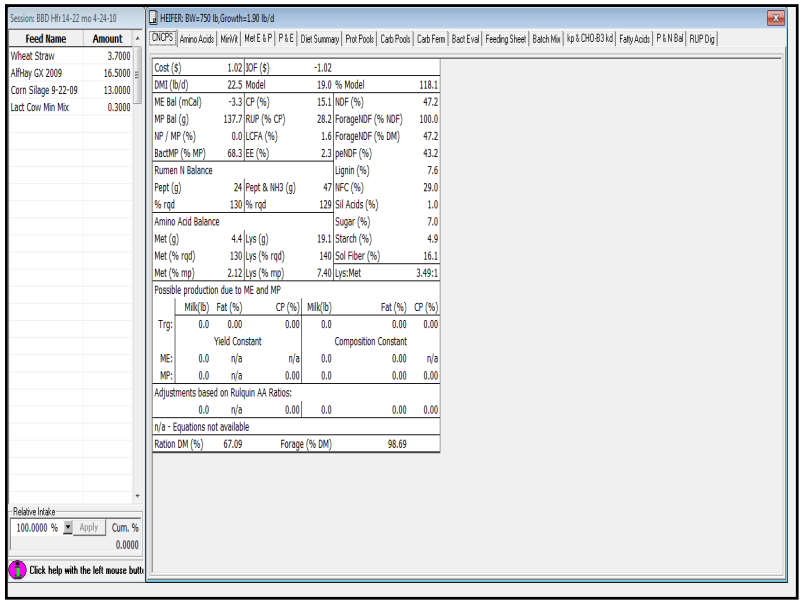


Delayed Breeding

- Waiting too long to initiate breeding often results in over-conditioned heifers
- Frame growth slows down as heifers mature
- Older heifers tend to gain excessive body condition
- Results in more calving difficulties and metabolic disease



Protein to Energy Ratio Pregnant Heifers

Total	20.74	22.43	-1.69	898	753	145
Maint	20.74	12.49	8.26	898	491	407
Preg	8.26	0.00	8.26	407	0	407
Lact	8.26	0.00	8.26	407	0	407
Growth	8.26	9.94	-1.69	407	262	145
Reserves	-1.69	0.00	-1.69	145	0	145

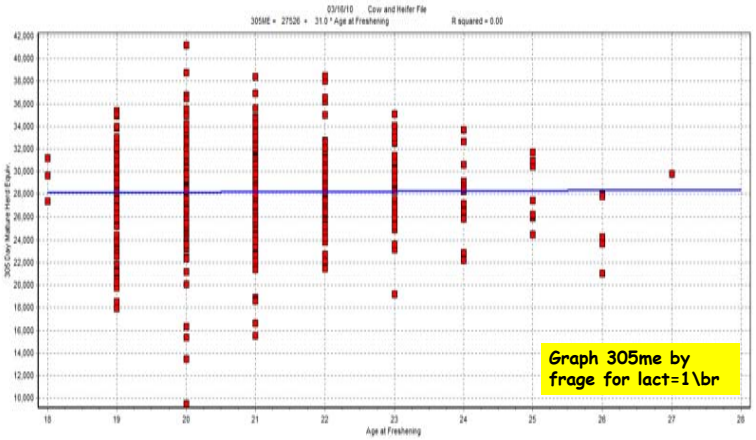
DMI Predicted	19.2	lb/d	Pept & NH3 Bal	52	g/d	131 %
DMI Actual	22.9	lb/d	Pept Bal	19	g/d	122 %
Predicted Ruminal pH	6.46		Urea Cost	0.285	mCal/d	

Target Growth	1.90	lb/d
Input Growth	1.90	lb/d
ME Allowed Growth	1.60	lb/d
MP Allowed Growth	2.93	lb/d
AA Allowed Growth (Histidine)	3.53	lb/d
Conceptus Weight	0.00	lb

Close-up Heifers

- Larger dairies: separate heifers from older cows
- Decrease competition at feed bunk and increase dry matter intake prior to calving
- Provide adequate bunk space
- Adjust ration according to number of animals on daily basis, especially if using neg DCAD
- Formulate for lowest DMI in closeup group
- Provide more space in open maternity areas to decrease DOA's

305ME = 27526 + 31.0 * Age at Freshening R squared = 0.00
No impact of age at first calving for lact=1



No Difference in Milk Production Parameters by Fresh Age

sum w4mk w12mk 305me by frage for lact=1 frage=1-24\b

By FRAGE	%COW	#COW	Av W4MK	AvW12MK	AV305ME
1-6	1	4	69.8	76.2	29872
1-7	15	70	62.6	72.2	27618
1-8	32	151	66.8	73.9	28172
1-9	24	114	67.2	74.0	28178
1-10	17	82	69.6	74.8	28468
1-11	9	44	70.8	77.0	28958
2-0	3	13	68.8	74.8	27602
Total	100	478	67.3	74.2	28215

Does ADG affect Lact=1 performance?

By ADG	Pct	Count	Av M305	AvME305
1.64	25	113	21340	27626
1.81	23	107	22086	28925
1.91	26	120	22676	30094
2.07	26	118	22864	30815
Total	100	458	22274	29426

Does ADG affect Lact=1 performance?

By ADG	Pct	Count	Av PEAK
1.64	25	113	81
1.81	23	107	82
1.91	26	120	86
2.07	26	118	89
Total	100	458	85

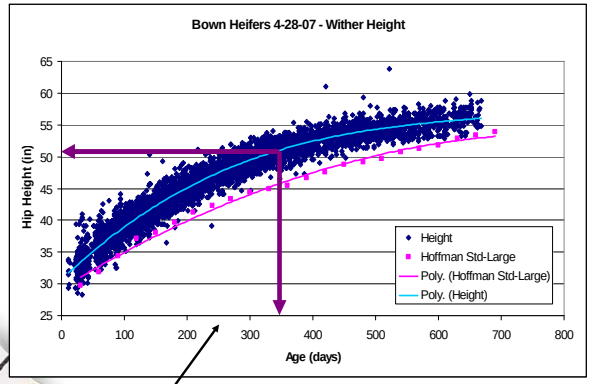
Heifers Needed per 100 Cows

Cull Rate	22 Mo	23 Mo	24 Mo	25 Mo	26 Mo	27 Mo	28 Mo	29 Mo	30 Mo
20%	38	42	46	48	52	56	61	63	67
22%	42	46	50	54	58	63	67	69	73
24%	46	50	54	58	63	67	71	75	81
26%	48	54	58	63	69	73	77	81	87
28%	52	58	63	69	73	79	83	87	94
30%	56	63	67	73	79	83	89	94	100
32%	61	67	71	77	83	89	96	100	106
34%	63	69	75	81	87	94	100	106	112
36%	67	73	81	87	94	100	106	112	121
38%	71	77	85	92	98	106	112	118	127
40%	75	81	89	96	104	110	118	125	133

Optimized Heifer Growth Weight Chart (birth to calving)

345-350 days

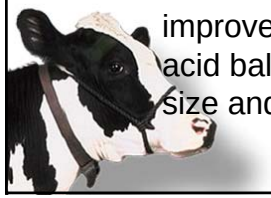
Optimized Heifer Growth Height Chart (birth to calving)



345-350 days

Nutritional Considerations

1. Rations formulated to increase frame size without excessive body condition.
2. Previous NRC overestimates energy and underestimates protein needed to accomplish increased frame size without excessive fat deposition.
3. Maximize rumen microbial growth: improves feed efficiency, optimizes amino acid balance, enhances growth in frame size and muscle deposition



Nutritional Considerations

4. Maximize dry matter intake: feed bunk space, fresh feed & water, good quality forages, clean dry & comfortable environment.
5. Monitor body condition scores
6. The nutritionist should support the principle of optimizing heifer growth for the program to be successful

Summary

- Good calf management procedures must be in place
- Accelerated growth program will not compensate for poor management
- Colostrum management just as important
- Calves must have free choice water
- Sanitation of environment and utensils
- Rations must be formulated to maximize growth without becoming over-conditioned